Rosh Hashonah Issue

THE CANNON

September 25, 1979 | University of Toronto Engineering Society | Volume II Number 2

University Research: Artificial Pancreas

The CANNON, realizing thot highly interesting research is performed right in our university community, will frequently run feature articles on those areos investigated in our faculty.

Michael V. Sefton, University of Toronto Professor of Chemical Engineering and former Engioeeriog Society President has heen doing research of significance in medicine and engineering. Especially exciting is his development of a controlled release micropump (artificial pancreas).

The following interview with Prof. Sefton was conducted hy Cannon assistant editor Susan Samuels. The interview was conducted on June 26, 1979 at the University of Torooto.

Cannon: In what major research areas are you iovolved?

Sefton: We're working in four major research areas. The two primary research areas are the development of an artificial pancreas, aod the development of a hlood compatihle material. We are also working on developing monitors that can he used to detect toxic materials in the work place and we're doiog fundamental work on polymers and diffusion in polyurethane of practical significance.

Cannon: When did your work on the artificial pancreas come ahout?

Sefton: It hegan at a meetiog of the Biomaterials Society in 1975, where Dr. Michael Alhisser of the Hospital for Sick Children was discussing his work on an artificial pancreas.

Cannon: What did their models consist of?

Sefton: Their model was relatively large-tahletop size. It coosisted of a glucose seosor, computer, and infusion pump. The apparatus would continuously monitor the glucose level, compute the required in-

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Women's onnuol **Wino and Cheese Party** is coming. For more details see Tiny Toike Page.

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Chemistry and the Environment

Dr. Rapson, University Professor in the Deportment of Chemicol Engineering ond Applied Chemistry ot the University of Toronto. Dr. Ropson delivered the Conodo Medol oddress, on which this poper is bosed, to the SCI's Conodion Section in Toronto on 21 November 1978.

The **SCI Canada Medal** wos founded in 1939 to be oworded every two yeors for outstonding services to the Conodion chemicol industry.

The chemical industry has heen fighting a rearguard as environmeotal activists have attacked it from many directions. This must change! Chemical industry must take the offensive. It must stress the great cootrihution of chemistry to the advancemeot of the welfare of mankind in a multitude of ways: in food production, in health, in materials of coostruction, in protection of the eovironmeot, in improviog the standard of living, in increasing the enjoyment of life. Chemistry has uowittingly caused significant harm to the environment in some ways, hut chemistry has provided aod will cootioue to provide the meaos of correcting the damage to the enviroomeot.

Because so much remains to he accomplished to give everyone clean water aod clean air, the puhlic does not realise how great the progress through applied chemistry aod chemical eogineering has heen in the past two decades. As a simple example, 15 years ago io my office, eveo with all the windows closed, every morning, every surface, every exposed paper on my desk would he covered with hlack particles entering with the Toronto air leaking in. We installed filters on all the windows, which made a hig improvement. Today these filters have all heen removed and, even with the windows opeo wide, very little soot is noticed.

There is a widespread view that the waste products of chemical industry are the main contaminants of the environment, hut that is not so. The waste products of human nutritioo are the major contaminants of the waterways of the world. The second largest contrihutor is the waste from agriculture aod animal hushandry, fertilisers and decayed vegetahle matter leached from the land, and the waste products of animal nutrition. This can only he controlled adequately hy an enormous investmeot in recycling these wastes hack to the laod or, where this is not possihle, in sewage treatment plants.

For many years, the rivers, lakes aod oceaos of the world could accept these wastes and purify them. But as the world population expanded exponentially so did industry and agriculture. The load of wastes hecame greater thao our waterways could handle. For example, the St. Lawreoce River is essentially dead, with respect to useful marine life, hetween Montreal and Quehec, mostly hecause less than 8 per cent of the sewage of Montreal receives any treatment, although treatment plants are now under constructioo on a huge scale. Therefore, the added effect of industrial wastes can hardly he noticed in that river. This gives the industrial plants time to apply chemistry to eliminate their wastes and many companies are taking advantage of this opportunity.

Benefits versus costs

In any proposal for environmental improvement, the henefits must he weighed agaiost the costs. This must he the ceotral theme of governmeot aod of industry in a concerted, aggressive campaign of puhlic education. It will require collahoratlon for the common good, oot confrontation.

Four specific chemicals have prohahly added more man-years to human life than all other factors comhined. These are: chlorine, through disinfection of water and sewage; penicillin (and its related hiocides), hy controlling hacterial infections; DDT, hy destructioo of insects which propagate malaria, typhus and other diseases; and 2, 4-D, by destruction of weeds to increase crop yields to feed

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University Research

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sulin dose, and feed that amount in. Based on that talk, I recognized that there was a need for a device to deliver insulin.

Cannon: How many diabetics are there in Canada?

Sefton: There are some 500,000 diabetics in Canada. It is estimated that there are actually twice as many. Forty-five percent of that 500,000 require taking insulin and are termed juvenilediabetics. This device is intended for these people.

Cannon: What medical problems do these people suffer from and how can your device help?

Sefton: These diabetics suffer complications and secondary diseases after being on insulin. It appears that being on insulin alone or some aspect by which we administer insulin is inadequate for restoring the health of these people. These people suffer secondary diseases such as kidney disease, blindness, and a higher incidence of arteriole sclerosis, all of which would tend to shorten the life of a diabetic. The current mode of insulin delivery, i.e., once per day is inadequate for controlling blood sugar. Thus there are times when the blood sugar levels are too low, and it is thought that these periodic deficiencies are sufficient over a long period of time to cause the secondary diseases. Hense the need to put diabetics on a finer glucose control by delivering insulin at a rate more closely to what is needed.

Cannon: What were some of *the problems that you were* going to encounter when your research began?

Sefton: One of the problems was to develop a miniature pump capable of performing a delivery function. A method of administering a drug over a long period of time at a constant rate is to encapsulate that drug in a membrane and allow that drug to diffuse through to body solutions directly. However, we had to develop a means by which one could change the rate of delivery through the membrane. We thought about taking a membrane that would give the basal output of insulin which would be required between meals. During meals the output would have to be increased by perhaps a factor of ten. We thought that this could be accomplished by repeatedly squeezing a membrane, almost as though it were a sponge squeezing out an extra quantity of insulin. It became a matter of finding out which membrane had the right combination of permeability and compressibility. Most membranes were too stiff to be easily compressed.

Cannon: What membrane did you finally come up with?

Sefton: As the membrane we used an easily compressible polyurethane foam. Transport of the insulin through the foam would give the basal flow. However, at the moment, the flow rate is too high. It is being reduced by using two membranes in series, one which controls the basal delivery, and the other, the foam which controls the augmented delivery.

Cannon: How is the flow augmented?

Sefton: Originally there was a glucose sensor. However glucose sensors don't work for long periods of time when in contact with blood. Instead, when the diabetic sat down to a meal he would turn on a switch on the device that would cause the infusion of an increased amount of insulin according to some pre-programmed set-up.

Cannon: What are some other problems that are now being encountered?

Sefton: At the momemnt reliability is a major problem. for example, there are devices which have valves, ours does not, and if the valves were to stick, a fatal dose of insulin would be delivered. Leakages have also been a problem. These mechanical problems have to be worked out at a much higher degree of reliability than most other conventional engineering devices. Also, commercial batteries generally have inadequate current supply and must be rechargable. The obvious intension is to make the device implantable. There are four major components to the system: the actual pump, the insulin reservoir, tha battery pack, and the control box. The insulin reservoir, part of the control box, and possibly the battery would be implanted. Getting enough insulin into a small enough volume with a high enough concentration to last a sufficient length of time and still maintain its stability remains another problem to be solved.

At the present time Prof. Sefton is in Germany delivering a paper on the artificial pancreas. It is hoped that this device will be ready for clinical use in a few years. Through the implementation of this device thousands of people will reap the benefits.

EDITORIAL

With many new members of the Engineering Society taking office recently, now would be a good time to think about your responsibility to the people who elected you. Is it not to lead them, and to make decisions in a way in which one believes will best benefit them? Does this not include having a knowledge of what you are expected to make a decision on?

During the last Council meeting a particularly emotional business venture which the Society had entered into being was being voted on. It was noted that many first and second year reps did not have much knowledge of the issue at hand, and a need for more information was expressed. The information received was that the Executive had made a decision and they should be trusted. Is this showing responsible government? Since only one officer of the Society had been elected (secretary) the rest having been acclaimed, the question raised is: to whom are they accountable? The voting public?

The instigators of the CANNON had meant it to act as a vehicle through which the Society could inform its members of vital issues so that reps could indeed make mature, responsible decisions. Thus far not one submission from the Society has been received — this does not mean though that they are doing nothing.

Does the Executive Committee expect all their decisions to be given a rubber stamped O.K. If so, why bother going through the motions?

Helping You Fight Unemployment

No need to be an unemployed victim of the "Unconcerned in October... Up the Creek in April" syndrome. Start your year off on the right foot... make use of any or all of the following programmes and services offered by the Career Counselling & Placement Centre.

GRADUATING ENGINEERS - PERMANENT JOBS:

a) **On-campus Recruitment:** The first step for those 1980 grads who expect to enter the permanent job market next Spring is participation in this programme. Over 250 representatives of national business, industry and government visit the University of Toronto campus to interview graduating students for permanent, career employment. In general, the demand for graduating Engineers is high and opportunities are extensive. Details of how you can participate in this programme will be outlined in 'Introductory Employment Seminars' held between September 11 - 28. These will be followed by "skill" training workshops to help you in the preparation of a resume and for the interview situation. Remember... **now** is not the time to procrastinate... interviews will begin October 22; application deadline dates as early as October 4th!

b) **Permanent Job Registry:** A service available for University of Toronto graduates, alumni and students, who are seeking **immediate**, full-time career career plans as well as developing employment. The jobs listed here (over 2000 annually) cover a good cross-section of employment opportunities available in the current market-plaace. 1980 grads should investigate this service in the early Spring.

c) **Graduate Dossier Service:** Established to assist masters and doctoral candidates seeking academic postions, the Dossier Service permits the job seeking candidate to respond to requests for **confidential** letters of reference in addition to copies of the cirriculum vitae and undergraduate and graduate transcripts. In addition, seminars on the employment search, both within and without the academic sphere will be offered throughout the year.

SUMMER ON-campus Recruitment: An excellent programme to utilize in your search for course-related summer jobs. Interviews start **early** (November). Watch for up-coming information seminars on how you can participate.

b) **Individual Job Listings:** Having a part-time job for the academic year is a good way of gaining valuable work experience and avoiding those ol'financial blues! In addition to the summer on-campus programme, over 8,000 individual summer and part-time jobs are listed with the Centre each year. The key to finding a good job, possibly related to your engineering studies, is to start early.

"TINKER, TAILOR, SOLDIER...???" For assistance in formulating and clarifying your successful techniques for obtaining a job, the Centre's CAREER COUNSELLORS can assist. An extensive variety of courses and workshops will be offered throughout the academic year including such topics as resume and interview preparation, job search techniques etc.

CAREER INFORMATION LIBRARY: One of the most comprehensive libraries in Canada, our library contains literature on numerous careers; calendars from universities and colleges in Canada, the U.S. and overseas as well as directories of potential employers, information on over 1,200 individual companies and current market research reports on prospective employment opportunities for engineers. Plus much, much more...

WHEN YOU NEED US, WE'LL BE HERE

Watch for our regular column of up-coming events.

Career Counselling & Placement Centre
(Bloor at Spadina)
344 Bloor Street West, 4th Floor

978-2537

Hours: (academic year)

Monday Wednesday, Thursday
8:00 a.m. - 6:00 p.m.
Tuesday
8:00 a.m. - 8:00 p.m.
Friday
8:00 a.m. - 5:00 p.m.

ELECTRICAL CLUB PRESENTS:
The Annual Football Tournament

Sunday, Sept. 30/79.

West Playing Field (behind U.C.)

9:30 — noon

All years are welcome to enter a team.

Liquid Refreshment will be provided —

(And it won't be Gatorade)

the CANNON

978-5377

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Ms. Dana Stonkus

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Ms. Susan Samuels

With special thanks to:

Alan Suran
Bruce Thomson
Wendy Eng
Eric Hartwell

The CANNON is a publication of the University of Toronto Engineering Society. It is published to announce EngSoc events, discuss Faculty and educational matters, present technical and University news and to be an open forum for the opinions and interests of members of the Faculty. All those who would like to help with the CANNON are most welcome.

Submissions to the CANNON are also welcomed. They should be typed. The deadline for submission of articles for the upcoming Tuesday's CANNON is Thursday at five. EngSoc announcements must be in by noon Monday. The editor reserves the right to edit letters.

The CANNON office is located in the EngSoc offices: Third Floor, Old Metro Library, 20 St. George St., University of Toronto, M5S 2E4.

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Letters to the Editor

Sept. 1979

Dear Cannon Staff

The Cannon has become a garbage newspaper!!

Your Sept. 5th edition bore hints of the Toike Oike mentality. When I read a "technical newspaper," I don't want to read phrases such as "dumb F" or see beer ads or "Band With the Runs" advertisements. Light-bearted buffoonery does not belong in the Cannon—nor does gossipping, beer-promoting, or swearing. We have the Toike Oike for that!!

Last year, Dr. Scott of Mechanical Engineering contributed valuable and interesting articles. Please continue this trend. Invite profs. to submit articles. What are the merits in pursuing a master's programme? Couldn't ads be from an Engineering firm? Sooner or later we shall be Engineers. Companies that advertise their wares today are investing in their future sales!!

Stonkus and Samuels have done our Cannon a discredit. Your first publication dictates the path of subsequent publications. You're going down the Toike Oike trail! Engineers are NOT beer guzzlers who can demolish 40 beers. We are professionally trained technical people. Our language and actions should show this.

Wilson Lee-Wing

Graduate, Mechanical Engineering

P.S. The Toike Oike is not funny. Cuss words scattered over a page haphazardly shows a poor taste for words and style. The last funny Toike Oike was read in 1978.

Editor's Note:

According to article 3 of The Cannon Publishing Policy: "Announcments and articles submitted by Society members shall take precedence over all other publication material."

September 18/79

The Editor,
The Cannon

Dear Sir,

Congratulations on a fine first issue! Not only was the content interesting and informative, but on top of that the layout was very well done — almost artistic (for an engineer).

However, the entire issue was marred by a glaring error on the masthead. Surely you must realize that the word "Ms" (according to Dear Abbey) is not an abbreviation, and so should not be written with a period!

Yours ever so sincerely,

Eric Hartwell

Editor's Note

According to Webster's Dictionary it does have a period.

the Environment

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the expanding world population. In addition to saving millions of people from death these four chemicals have prevented untold human suffering through disease and malnutrition.

An example of the lack of adequate cost-benefit analysis is the banning of DDT in many countries. No other insecticide has such widespread effectiveness with so little damage to human beings. Every person reading this has DDT stored in his liver, without detectable harm. If you were born before 1944, you have had it there for at least 34 years, and you are still alive! DDT is known to cause thinning of the egg shells of certain wild birds, causing a low survival rate which threatens a few species with extinction. No other significant damage has been established, except the destruction of some useful insects through improper spraying for control of harmful insects. This calls for value judgements which makes it a political issue. Do the great benefits of DDT outweigh the costs of its minor damage? Incidentally, DDT is allowed on only one crop in Canada: tobacco. What irony; to help produce the most thoroughly documented cause of the rapid increase in lung cancer!

There is another example of the lack of cost-benefit analysis. At a conference in Geneva in October 1978 organized by the European Research Group for Oral Biology it was reported that, although heavy doses of saccharin and cyclamates have produced increased incidence of bladder tumours in the second generation of rats, comparable tests on monkeys over eight years have yielded no evidence of cancer. The statement said, 'On a cost benefit approach the slight risk — if any — of saccharin is more than offset by the risk of obesity, cardiovascular disease and diabetes which are affected by sugars'. The banning of saccharin and cyclamates from soft drinks and foods has created a particular hardship for the many diabetics among the human race and also for the multitude who are trying to decrease their weight to improve their health and longevity.

C-MOS processor to control attitude

The planned October launch of Magsat, a small U.S. satellite that will study the earth's magnetic fields, will mark the first use of a complementary-MOS microprocessor in space. The processor will monitor and control the space vehicle's pitch, roll, and yaw.

Watching carefully will be John Hopkins University's Applied Physics Laboratory, which designed and built Magsat, and RCA Corp's Solid State division, which supplied its 1802 8-bit processor to APL to serve as the heart of the attitude-control system.

The C-MOS chip was chosen "because we needed low power on such a small spacecraft, and n-channel MOS just didn't make it," says Glenn H. Fountain, APL program leader in Laurel, MD. The 1½-pound processor package requires only 1 watt of power, which the satellite's solar panel provides. The processor can aid the accuracy of magnetic-field measurements by providing ground observers with the axis of the spacecraft within 14 seconds of arc. Thus the observers know more exactly where the measurement package aboard the satellite is aimed.

The application is a milestone of sorts for C-MOS parts, indicating their rising acceptance as users become more familiar with their reliability histories. Radiation sensitivity, sometimes a C-MOS question mark, does not arise, for the orbit is not subject to radiation.

Magsat is small as satellites go, but its mission is expected to provide precise data which will aid in the discovery of new deposits of oil and minerals. Designed for launching aboard a small Scout rocket, the spacecraft is just 62 inches long with a 26-in. diameter and a 402 lb. launch weight.

During the expected 90-day life of the satellite, its elliptical polar orbit will take it as close as 340 kilometers from earth or as far as 570 km. After achieving orbit, it will extend a boom 6.02 meters aft with a sensor platform containing highly accurate scalar and vector magnetometers, a precision sun sensor, and mirrors that use an optical system to define the orientation of the sensor platform to the instrument module at the base of the boom.

That module, Fountain explains, contains a pair of star cameras for precise determination of the spacecraft's attitude. "The control system must maintain attitude so that the magnetometers, sun sensors, star cameras, and solar panels are properly oriented," he says.

Data. "Magsat flies like an airplane relative to earth, with one side facing downward and another oriented toward the normal of the orbit," he explains. The attitude-control system built around the 1802 receives roll and pitch data from a combination of sensors. One is an infrared detector that scans the earth's horizons and is linked via the microprocessor to an electrically driven reaction wheel; the wheel's voltage can be varied to provide torque and thus alter the satellite's roll and pitch. Also feeding into the processor control system are a pitch-axis gyroscope and magnetometers separate from those in the instrument module.

The only ground control necessary is an update, approximately once a week, of registers that store the changes in orbital position and attitude. Using input from the sensors, the control system activates appropriate torque coils to make attitude corrections. Should any of the sensors show abnormal output, indicating a malfunction, the microprocessor can shift it off or bypass it in making corrections. Magsat's system is also equipped to correct spacecraft nutation, commonly referred to as jitter, Fountain adds.

Reprinted from Electronics Vol 52 No 18

IMPORTANT SEMINARS TO REMEMBER

Prepare for the on-campus programme now by attending the **Resume/Interview Preparation Seminar** to be held on Tuesday, September 25, from 5 to 7 pm. Bill Watson from DOFASCO will be the guest speaker.

Career Day will provide you with the opportunity to meet with and talk to representatives from various companies. Career Day happens September 26, 1979 from 11 am — 4 pm at University College, East and West Halls.

TINY TOIKE PAGE

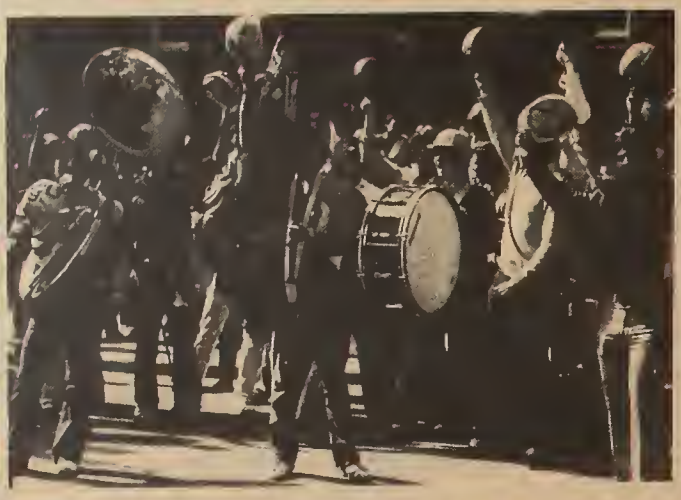
Club Notices

Chemical

first smoker — Sept. 25
Chemical common room

Eng Sci

first smoker — Oct. 4 5:00 pm
Physics common room



Geological

Smoker — Sept. 27 5:00 pm WB 143

Mechanical

Meeting on Sept. 27 12:00 pm
first Nick Night — Wed. Oct. 3

Women's Wine and Cheese Party

Thursday, September 27th. at 5:00 p.m.
At tbe International Student Centre
Admission: Merely a Dollar

Blue and Gold Offers

Entertainment for the Gents,
Friday, Sept. 28/79 at High Noon
Med. Sci. Auditorium

social committee meeting

Re: OKTOBERFEST
Thursday, Oct. 11tb at 1:00pm.
In tbe Stores.

Rugger

Engineering rugger practices bave begun—Tuesdays, Wednesdays and Thursdays at 8:00 a.m. on tbe playing field at Hart House. New Players especially welcome. No experience necessary—only a strong desire to beat Law.

Do gluons really exist?

Newspaper stories of the discovery of the gluon - an elusive particle believed by tbeorists to bold nuclear matter togetber — bemused many pbysicists in Europe, not least because tbe Americans were proclaiming a discovery made on an accelerator in Hamburg. Tbe announcement of tbis breaktbrougb in particle pbysics research came during an international conference at tbe Fermi Laboratory in Batavia, Illinois. But what was all tbe fuss about?

In recent years pbysicists bave been working toward a tbeory for the strong nuclear force tbat binds protons and neutrons togetber inside tbe atomic nucleus. There is already abundant experimental evidence that protons and neutrons are not tbemselves truly fundamental particles, but instead consist of entities called quarks. Quarks — wbich bave not yet been observed individually — combine in various ways to make different nuclear particles — pbysicists believe tbat tbere are tbree quarks in a proton, for example.

But quarks alone are not sufficient to lead to a matbematically respectable tbeory of tbe strong nuclear force — such a theory requires tbe presence of "gluons", or particles that bind tbe quarks together like nuclear glue.

Tbe new results announced in tbe US are from experiments performed by four different researcb groups on the accelerator called PETRA, in Hamburg. More than 300 pbysicists from West Germany, Japan, the US, Britain, Norway, France, Israel and Cbina are involved in tbese experiments wbicb study tbe debris produced when beams of electrons and positrons travelling in opposite directions smash into eacb other. The researcbers do not actually "see" gluons in tbeir apparatus. At the bighest energy at wbich PETRA runs they find tbat a small fraction of electron-positron collissions produce three sprays, or "jets", or particles wbicb all lie in the same plane. The pbysicists call tbese "propeller", or "Mercedes", events after their three-pronged apperance, and believe that the jets originate as a gluon, quark and antiquark that materialise from tbe electron-positron annihilation.

According to David Saxon from tbe UK's Rutberford Laboratory, and a member of the team called TASSO — the first group to report the tbree-jet events — tbe results revealed in tbe US do not represent a conclusive proof of tbe existence of gluons.

The evidence for gluons is therefore weak, so wby have these results been hailed as so remarkable, particularly in the US? The only conclusion seems to be tbat American particle pbysicists are trying bard to keep up the momentum for federal funding for tbeir expensive form of researcb. The battle is already on for the next generation of accelerators, to go to higber energies, so pbysicists need to prove tbat future expenditure is well invested.

(Reprinted from News Scientist Vol. 83 No. 1171)

Meet with company reps
and find aut what
appartunities exist
far yau at

CAREER FAIR

WED. SEPT. 26

EAST AND WEST HALL, U.C.

Fram 11 a.m. ta 4 p.m. businessmen and prafessianals will be available ta answer questians regarding their campanies and yaur patential career. There will alsa be a seminar given in the Craft Chapter Hause at 1:00 p.m., Raam 183, by the Career Caunselling and Placement Centre an careers far Arts grads. We encaurage students fram all disciplines and all years ta attend, after all,

IT'S YOUR FUTURE!
Sponsared by AIESEC and the Career Caunselling and Placement Centre
Participating campanies posted an board acrass fram SS1091

EngSoc Council Ratifies Canning of Text and Editing System

The first full Engineering Society Council meeting of the school year saw the largest attendance wintessed by tbis reporter in tbe last two years. Council ratified a motion passed by tbe Executive on September 11 wbich required the contract with Steel Breeze Systems for the design and construction of a 'Text Entry and EDiting System' to be ter-curred" before delivery of the system as tbe primary reasons for the Executive's decision.

Vice President: Administration Ken Smitb cited "uncertainty of a completion date" and "tbe probability of prohibitive costs still to be incurred" before delivery of the system as tbe primary reasons for the Executive's decision.

It is anticipated by tbe Executive that the partially assembled units could be sold as scrap for "at best $3000" (the components originally cost the Eng Soc a claimed $5000). According to Communications Chairman John Byrne, tbe net loss to the Society would be "approximately $3000", comprosed of a $2000 loss on the resale of components and $1000 already paid to Steel Breeze Systems for labour.

In other business, Council voted to renew tbe Eng Soc's sponsorship of "the newspaper" as a U of T student club. As well, a motion was passed to autborize consideration of the biring of a third employee of tbe Society to handle the burgeoning taks of purchasing for the Engineering Stores and of Society bookkeeping. Present Society employees include secretary Ella Lund-Thomsen and Stores employee June Massie.

by Hubert Vogt